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(54) ELECTRIC WIRING/OPTICAL WIRING COMBINED FLEXIBLE PRINTED CIRCUIT BOARD AND SUBSTRATE THEREFOR

(57)Abstract:
PURPOSE: To provide the electric wiring/optical wiring combined flexible printed circuit board formed by housing electric wiring and optical wiring in the same wiring board and the substrate for such circuit board.
CONSTITUTION: This electric wiring/optical wiring combined flexible printed circuit board is formed by using a high-polymer film having optical waveguide and metallic wiring formed on it as main constituting elements. The electric wiring/optical wiring combined flexible printed circuit board is formed by using the high-polymer film having the optical waveguide and metallic foil formed on it as main constituting elements. The main base materials of the respective high-polymer films are polyimide and more particularly adequately polyimide of org. tetracarboxylic acid and 2,2'-bis(trifluoromethyl)-4,4'-diaminobiphenyl. Since the circuit boards have characteristics, such as resilience and lightness, the circuit board makes contribution for high advancement of future optical communication apparatus, optical information device, etc. The circuit boards are easily made from the substrates.

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* NOTICES *

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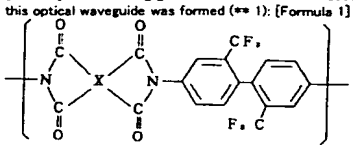
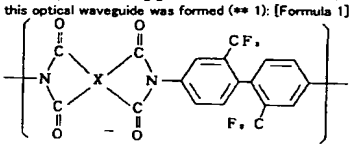
CLAIMS

[Claim(s)]
[Claim 1] The electric wiring and the optical wiring mixed-loading flexible printed wiring board characterized by using as the main component the high polymer film in which optical waveguide was formed, and metal wiring.
[Claim 2] The electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards characterized by using as the main component the high polymer film in which optical waveguide was formed, and a metallic foil.
[Claim 3] The electric wiring and the optical wiring mixed-loading flexible printed wiring board according to claim 1 characterized by using polyimide as a main base material of the high polymer film in which this optical waveguide was formed.
[Claim 4] The electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards according to claim 2 characterized by using polyimide as a main base material of the high polymer film in which this optical waveguide was formed.
[Claim 5] The following general formula as a main base material of the high polymer film in which this optical waveguide was formed (** 1): [Formula 1]



They are the electric wiring and the optical wiring mixed-loading flexible printed wiring board according to claim 1 characterized by using the polyimide containing the repeating unit expressed with (however, the organic radical of tetravalence [X]).
[Claim 6] The following general formula as a main base material of the high polymer film in which this optical waveguide was formed (** 1): [Formula 1]



They are the electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards according to claim 2 characterized by using the polyimide containing the repeating unit expressed with (however, the organic radical of tetravalence [X]).

[Translation done.]

http://www4.ipdl.ncipi.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.... 2005/10/03

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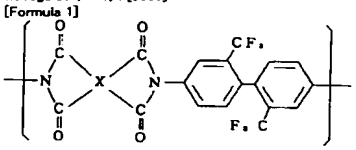
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the electric wiring and the optical wiring mixed-loading flexible printed wiring board which used the high polymer film, and its substrate.
[0002]
[Description of the Prior Art] Many flexible printed wiring boards to small electronic instruments, such as a camera, an electronic clock, and a calculator, and electronic parts are used taking advantage of the merit which can wire freely in narrow space. It is expected that application fields, such as a small computer, the exchange, and OA equipment, will be expanded further from now on. On the other hand, development of the various components for optical communication is performed with utilization of the optical transmission system by development of an optical fiber. Moreover, establishment of the optical wiring technique of mounting these light components in high density, especially an optical waveguide technique is desired. Generally, the conditions of ** excellent in thermal resistance which can control the refractive-index difference of ease [manufacture], a core, and a clad with small optical loss are required of optical waveguide. As low loss optical waveguide, the quartz system is mainly examined, and with the optical fiber, like, since light transmission nature of a quartz is very good, also when [finishing / an actual proof] it considers as waveguide, in 1.3 micrometers, 0.1dB [/] or less low optical loss-ization of cm is attained for wavelength. however, large-area-izing which needs an elevated temperature is difficult at the time of production which needs long duration for the optical waveguide production — etc. — there is a trouble on manufacture. On the other hand, film-izing and shaping at low temperature are possible for macromolecule optical waveguides, such as polymethylmethacrylate, and they have the fault with the advantage in which a low price is expectable etc. that on the other hand it is inferior to thermal resistance. Since it is such, the macromolecule optical waveguide excellent in thermal resistance has come to be expected.
[0003] By the way, polyimide excellent in the thermal resistance used as a base film of a flexible printed wiring board does not almost have an application track record to optics, such as optical waveguide, until now. Although this invention persons are furthering researches and developments about the polyimide optical material applicable to optical waveguide, especially two points, a refractive index is [excelling in the permeability of light, when applying polyimide as an optical material, and] freely controllable, are important. this invention persons clarify transparent fluorination polyimide by JP,3-72528,A, and show clearly that refractive-index control required for formation of optical waveguide is possible by copolymerizing this fluorination polyimide by JP,4-8734,A further. Moreover, it has succeeded in production of optical waveguide using these fluorination polyimide as clarified in JP,4-9807,A, 4-235505, and 4-235506 each official report. It will be considered to be required with progress of an optical-communication technique and an optical-information-processing technique from now on that electric wiring and optical wiring are held in the same patchboard. However, there is no report of the flexible printed wiring board with which electric wiring and optical wiring were now held in the same patchboard.
[0004]
[Problem(s) to be Solved by the Invention] The purpose of this invention is to offer the electric

wiring and the optical wiring mixed-loading flexible printed wiring board with which electric wiring and optical wiring were held in the same patchboard, and its substrate.
[0005]
[Means for Solving the Problem] The electric wiring and the optical wiring mixed-loading flexible printed wiring board of invention of the 1st of this invention are characterized by using as the main component the high polymer film in which optical waveguide was formed, and metal wiring about the electric wiring and the optical wiring mixed-loading flexible printed wiring board with which this invention attains said purpose, and its substrate. The electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards of invention of the 2nd of this invention are characterized by using as the main component the high polymer film in which optical waveguide was formed, and a metallic foil.
[0006] The fundamental example of a configuration of the electric wiring and the optical wiring mixed-loading flexible printed wiring board of this invention is illustrated. In drawing 1 , a side elevation and drawing 2 show a top view, and drawing 3 shows a sectional view. In each drawing, in a sign 1, metal wiring and 2 show the cladding layer of optical waveguide, and 3 shows the core layer of optical waveguide.
[0007] Although 1 has copper, aluminum, gold, etc. as metal wiring, the copper usually used mainly with the current flexible printed wiring board is common. Except this is sufficient although the thickness of metal wiring has 35 micrometers of current, and 19 micrometers in use. Moreover, there is especially no limitation also about the width of face of metal wiring, and it is the same as that of a current flexible printed wiring board, and is good. Metal wiring may be stuck to the direct high polymer film, as shown in drawing, and it may be stuck through adhesives.
[0008] Moreover, the base materials of the cladding layer of the high polymer film in which optical waveguide was formed, and a core layer may be different polymeric materials that what is necessary is just polymeric materials. However, it is indispensable that the refractive index of a core layer is larger than the refractive index of a cladding layer. As a concrete ingredient, there are polymethylmethacrylate, polystyrene, polyester, polyimide, silicon resin, etc. From the track record in a flexible printed circuit board, and a heat-resistant viewpoint, polyimide is desirable. Furthermore, the following general formula to which development is progressing as optical waveguide (** 1) : [0009]
[Formula 1]



[0010] The polyimide containing the repeating unit expressed with (however, the organic radical of tetravalence [X]) is more desirable. However, if development of macromolecule waveguide besides future progresses, the ingredient can be used with a natural thing. The both are applicable although there are a multimode type and a single mode type of optical waveguides. Various dimensions are possible, although any, such as a globular form, a square, and a rectangle, are sufficient as a core configuration and a certain amount of limitation receives the dimension of a core with a waveguide type. For example, a core dimension has common about 1-100 micrometers in a square core configuration. Since clad layer thickness will lead to the loss of light if it becomes not much thin as compared with the thickness of a core layer, it is not desirable. The thickness of the grand total of a core layer and a cladding layer is thin, and a support film may be stretched when it cannot have a mechanical strength as a flexible printed wiring board.
[0011] The electric wiring and the optical wiring mixed-loading flexible printed wiring board

illustrated to drawing have various things, such as what is a thing of fundamental structure, for example, has electric wiring in both sides, a thing multilayered further, a thing with two or more core layers of optical waveguide, and a thing further made into the multilayer.
[0012] Electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards are what the high polymer film which gave optical wiring, and the metallic foil unified, and is the thing of the condition before performing wiring processing of electric wiring and an optical wiring mixed-loading flexible printed wiring board.
[0013] Electric wiring and an optical wiring mixed-loading flexible printed wiring board are produced as follows. The high polymer film which has optical waveguide first is formed, and a metallic foil is stuck with adhesives after that, or plating processing is performed. In this way, wiring processing is performed to the obtained electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards, and electric wiring and an optical wiring mixed-loading flexible printed wiring board are obtained. The high polymer film which has optical waveguide can be obtained by exfoliating from a substrate the macromolecule optical waveguide produced on the suitable substrate.
[0014]
[Example] This invention is explained in detail using an example below. In addition, this invention is not limited only to these examples.
[0015] The concentration 15wt% polyamide acid solution was obtained from an example 12, 2-screw (3, 4-dicarboxy phenyl) hexafluoropropane 2 anhydride (6FDA), the 2 and 2'-screw (trifluoromethyl) -4, a 4'-diamino biphenyl (TFDB), and N,N-dimethylacetamide (DMAc). After carrying out the spin coat of this polyamide acid solution on a silicon wafer, in oven, it heated at 160 degrees C by 70 degrees C for 2 hours, and heated at 380 degrees C by 250 degrees C for 1 hour for 30 minutes for 1 hour, and imide-ization was performed, and the polyimide film with a thickness of 30 micrometers was obtained. Next, the concentration 15wt% solution of the polyamide acid which is the precursor of polyimide with a larger refractive index than a lower cladding layer was obtained from the mixture (6FDA:90 mol%, pyromellitic acid 2 anhydride:10 mol%) and DMAc of TFDB and an acid anhydride. After carrying out the spin coat of this polyamide acid solution on the above-mentioned lower cladding layer, in oven, it heated at 160 degrees C by 70 degrees C for 2 hours, and heated at 380 degrees C by 250 degrees C for 1 hour for 30 minutes for 1 hour, and imide-ization was performed, and the core layer with a thickness of 10 micrometers was formed. The 0.3-micrometer aluminum film was formed with vacuum evaporationo equipment on this core layer. Next, it prebaked, after applying the usual positive resist with a spin coat method. Next, after irradiating ultraviolet rays using an extra-high pressure mercury lamp through the mask for pattern formation with a line breadth [of 10 micrometers], and a die length of 60mm, negatives were developed using the developer. After-bake was carried out after that. Next, wet etching of aluminum by which a coat is not carried out by the resist was performed. Polyimide was processed using the dry etching system after washing desiccation. And the etching reagent which described above the aluminum in the upper layer of polyimide removed, and the ridge mold optical waveguide of 10-micrometer width of face was obtained for the core layer. Furthermore, on this ridge mold optical waveguide, after carrying out the spin coat of a lower cladding layer and the same polyamide acid solution, in oven, it heated at 160 degrees C by 70 degrees C for 2 hours, and heated at 380 degrees C by 250 degrees C for 1 hour for 30 minutes for 1 hour, and imide-ization was performed, and the up clad with a thickness of 30 micrometers was formed. In this way, when it was immersed underwater and the polyimide optical waveguide on the produced silicon wafer was left, the polyimide film with which optical waveguide was formed exfoliated. This was dried at 100 degrees C under drawing and a vacuum for 1 hour. Next, 18 micrometers of copper were plated with the electroless deposition method to the polyimide film with which optical waveguide was formed, and electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards were obtained. Furthermore, electric wiring was formed by the usual patterning method, and electric wiring and an optical wiring mixed-loading flexible printed wiring board were obtained.

[0016]

[Effect of the Invention] The electric wiring and the optical wiring mixed-loading flexible printed wiring board of this invention can transmit an electrical signal and a lightwave signal to coincidence, and since it has flexibility and which lightweight description, it has the effectiveness which can contribute to the advancement of future optical-communication equipment and optical information equipment. Moreover, electric wiring and the substrate for optical wiring mixed-loading flexible printed wiring boards have the effectiveness which can produce easily electric wiring and an optical wiring mixed-loading flexible printed wiring board.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the side elevation of one example of the electric wiring and the optical wiring mixed-loading flexible printed wiring board of this invention.
[Drawing 2] It is the top view of the electric wiring and the optical wiring mixed-loading flexible printed wiring board of drawing 1 of this invention.
[Drawing 3] It is the sectional view of the electric wiring and the optical wiring mixed-loading flexible printed wiring board of drawing 1 of this invention.
[Description of Notations]
1: Metal wiring, 2:clad, 3 : core

[Translation done.]

ELECTRIC WIRING/OPTICAL WIRING COMBINED FLEXIBLE PRINTED CIRCUIT BOARD AND SUBSTRATE THEREFOR

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Publication date: 1994-10-07
Inventor(s): SASAKI SHIGEKUNI; others: 03
Applicant(s): NIPPON TELEGR & TELEPH CORP
Requested Patent: JP6281831
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EC Classification:
Equivalents:

Abstract

PURPOSE:To provide the electric wiring/optical wiring combined flexible printed circuit board formed by housing electric wiring and optical wiring in the same wiring board and the substrate for such circuit board.
CONSTITUTION:This electric wiring/optical wiring combined flexible printed circuit board is formed by using a high-polymer film having optical waveguide and metallic wiring formed on it as main constituting elements. The electric wiring/optical wiring combined flexible printed circuit board is formed by using the high-polymer film having the optical waveguide and metallic foil formed on it as main constituting elements. The main base materials of the respective high-polymer films are polyimide and more particularly adequately polyimide of org. tetracarboxylic acid and 2,2'-bis(trifluoromethyl)-4,4'-diaminobiphenyl. Since the circuit boards have characteristics, such as resilience and lightness, the circuit board makes contribution for high advancement of future optical communication apparatus, optical information device, etc. The circuit boards are easily made from the substrates.

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(43)公開日　平成６年(1994)10月７日

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	1/03		Ｄ　7011－4Ｅ		

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最終頁に続く

(54)【発明の名称】　電気配線・光配線混載フレキシブルプリント配線板及びその基板

(57)【要約】

【目的】　電気配線と光配線が同じ配線板に収容された電気配線・光配線混載フレキシブルプリント配線板及びその基板を提供する。

【構成】　光導波路を形成した高分子フィルムと金属配線とを主構成要素とする電気配線・光配線混載フレキシブルプリント配線板。光導波路を形成した高分子フィルムと金属箔とを主構成要素とする電気配線・光配線混載フレキシブルプリント配線板用基板。該各高分子フィルムの主基材としては、ポリイミド、特に有機テトラカルボン酸と、２，２′－ビス（トリフルオロメチル）－４，４′－ジアミノビフェニルとのポリイミドが好適である。

【効果】　配線板は、柔軟性、軽量などの特徴を有しているため、今後の光通信装置、光情報装置の高度化に寄与でき、該基板から容易に作製できる。

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【特許請求の範囲】

【請求項１】　光導波路を形成した高分子フィルムと金属配線とを主構成要素とすることを特徴とする電気配線・光配線混載フレキシブルプリント配線板。

【請求項２】　光導波路を形成した高分子フィルムと金属箔とを主構成要素とすることを特徴とする電気配線・光配線混載フレキシブルプリント配線板用基板。

【請求項３】　該光導波路を形成した高分子フィルムの主基材としてポリイミドを用いることを特徴とする請求項１に記載の電気配線・光配線混載フレキシブルプリント配線板。

（但しＸは４価の有機基）で表される繰返し単位を含むポリイミドを用いることを特徴とする請求項２に記載の電気配線・光配線混載フレキシブルプリント配線板用基板。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、高分子フィルムを用いた電気配線・光配線混載フレキシブルプリント配線板及びその基板に関する。

【０００２】

【従来の技術】フレキシブルプリント配線板は狭い空間を自由に配線できるメリットを生かしてカメラ、電子時計、電卓など小型電子装置、電子部品に多く使用されている。今後更に小型コンピュータ、交換機、ＯＡ機器など適用領域は拡大していくものと予想される。一方光ファイバの開発による光通信システムの実用化に伴い、種々の光通信用部品の開発が行われている。またこれら光部品を高密度に実装する光配線技術、特に光導波路技術の確立が望まれている。一般に、光導波路には、光損失が小さい、製造が容易、コアとクラッドの屈折率差を制御できる、耐熱性に優れている、等の条件が要求される。低損失な光導波路としては石英系が主に検討されて

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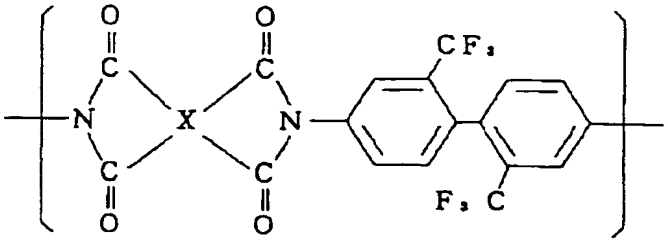
＊項１に記載の電気配線・光配線混載フレキシブルプリント配線板。

【請求項４】　該光導波路を形成した高分子フィルムの主基材としてポリイミドを用いることを特徴とする請求項２に記載の電気配線・光配線混載フレキシブルプリント配線板用基板。

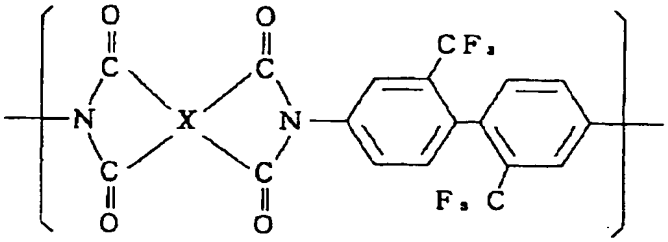
【請求項５】　該光導波路を形成した高分子フィルムの主基材として下記の一般式（化１）：

【化１】



※【請求項６】　該光導波路を形成した高分子フィルムの主基材として下記の一般式（化１）：

【化１】



おり、光ファイバで実証済のように石英は光透過性が極めて良好であるため導波路とした場合も波長が１．３μｍにおいて０．１ｄＢ／ｃｍ以下の低光損失化が達成されている。しかしその光導波路作製に長時間を必要とする、作製時に高温が必要である、大面積化が困難であるなど製造上の問題点がある。これに対してポリメチルメタクリレートなどの高分子光導波路は、フィルム化や低い温度での成形が可能であり、低価格が期待できるなどの長所がある一方耐熱性に劣るという欠点がある。そのようなことから耐熱性に優れた高分子光導波路が期待されるに至っている。

【０００３】ところでフレキシブルプリント配線板のベースフィルムとして用いられている耐熱性に優れたポリイミドは、これまで光導波路などの光学部品への適用実績はほとんどない。本発明者らは光導波路に適用可能なポリイミド光学材料について研究開発を進めているが、ポリイミドを光学材料として適用していく上で光の透過性に優れていること、屈折率を自由に制御できることの二点が特に重要である。本発明者らは特開平３－７２５２８号公報で透明なフッ素化ポリイミドを明らかにし、更に特開平４－８７３４号公報ではこのフッ素化ポリイミドを共重合することにより光導波路の形成に必要な屈

折率制御が可能であることを明らかにしている。また特開平４－９８０７号、同４－２３５５０５号、同４－２３５５０６号各公報で明らかにしているようにこれらのフッ素化ポリイミドを用いて光導波路の作製に成功している。今後光通信技術や光情報処理技術の進展に伴い、電気配線と光配線が同じ配線板に収容されることが要求されていくものと考えられる。しかしながら現在のところ電気配線と光配線が同じ配線板に収容されたフレキシブルプリント配線板の報告はない。

【０００４】

【発明が解決しようとする課題】本発明の目的は、電気配線と光配線が同じ配線板に収容された電気配線・光配線混載フレキシブルプリント配線板及びその基板を提供することにある。

【０００５】

【課題を解決するための手段】本発明は、前記目的を達成する電気配線・光配線混載フレキシブルプリント配線板及びその基板に関するもので、本発明の第１の発明の電気配線・光配線混載フレキシブルプリント配線板は、光導波路を形成した高分子フィルムと金属配線とを主構成要素とすることを特徴とする。本発明の第２の発明の電気配線・光配線混載フレキシブルプリント配線板用基板は、光導波路を形成した高分子フィルムと金属箔とを主構成要素とすることを特徴とする。

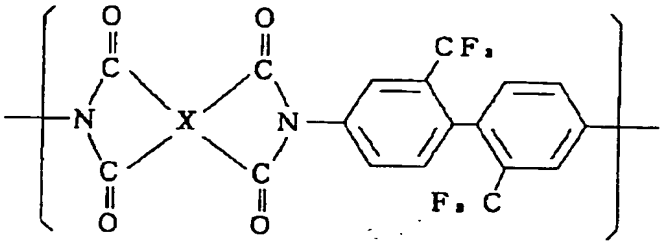
【０００６】本発明の電気配線・光配線混載フレキシブ＊ルプリント配線板の基本的な構成例を図示する。図１は側面図、図２は平面図、図３は断面図を示す。各図において符号１は金属配線、２は光導波路のクラッド層、３は光導波路のコア層を示す。

【０００７】１は金属配線としては例えば、銅、アルミニウム、金などがあるが、通常は現在フレキシブルプリント配線板で主に使用している銅が一般的である。金属配線の厚さは現在３５μｍや１９μｍが主流であるが、これ以外でも構わない。また金属配線の幅についても特に限定はなく、現在のフレキシブルプリント配線板と同様でよい。金属配線は図に示したように直接高分子フィルムに密着していても良いし、接着剤を介して密着していても良い。

【０００８】また光導波路を形成した高分子フィルムのクラッド層、コア層の基材は高分子材料であれば良く、異なる高分子材料であっても良い。しかしコア層の屈折率がクラッド層の屈折率より大きいことが必須である。具体的な材料としては、ポリメチルメタクリレート、ポリスチレン、ポリエステル、ポリイミド、シリコン樹脂などがある。フレキシブルプリント基板での実績、耐熱性の観点からはポリイミドが好ましい。更に光導波路として開発の進んでいる下記の一般式（化１）：

【０００９】

【化１】



【００１０】（但しＸは４価の有機基）で表される繰返し単位を含むポリイミドがより好ましい。しかし今後他の高分子導波路の開発が進めば、当然のことながらその材料を使用することができる。光導波路にはマルチモードタイプ、シングルモードタイプがあるが、その両方とも適用可能である。コア形状は球形、正方形、長方形等いずれでも良く、またコアの寸法は導波路タイプによってある程度の限定は受けるが、種々の寸法が可能である。例えば正方形のコア形状でコア寸法は１～１００μｍ程度が一般的である。クラッド層の厚さはコア層の厚さに比較してあまり薄くなると光のロスにつながるので好ましくない。コア層とクラッド層の総計の厚さが薄く、フレキシブルプリント配線板としての機械的強度を持ち得ない場合は支持フィルムを張り合せても良い。

【００１１】図に例示した電気配線・光配線混載フレキシブルプリント配線板は、基本的な構造のものであり、例えば電気配線が両面にあるもの、更に多層化したもの、光導波路のコア層が複数あるもの、更に多層にしたものなど種々のものがある。

【００１２】電気配線・光配線混載フレキシブルプリント配線板用基板は、光配線を施した高分子フィルムと金属箔が一体化したもので、電気配線・光配線混載フレキシブルプリント配線板の配線処理を施す前の状態のものである。

【００１３】電気配線・光配線混載フレキシブルプリント配線板は、次の通り作製する。まず光導波路を有する高分子フィルムを形成し、その後接着剤により金属箔を張り付けるか、メッキ処理を施す。こうして得られた電気配線・光配線混載フレキシブルプリント配線板用基板に配線処理を施して電気配線・光配線混載フレキシブルプリント配線板を得る。光導波路を有する高分子フィルムは、適当な基板上に作製した高分子光導波路を基板からはく離することにより得ることができる。

【００１４】

【実施例】以下実施例を用いて本発明を詳しく説明する。なお本発明はこれらの実施例のみに限定されるものではない。

【００１５】実施例１

２，２－ビス（３，４－ジカルボキシフェニル）ヘキサフルオロプロパン二無水物（６ＦＤＡ）と２，２′－ビス（トリフルオロメチル）－４，４′－ジアミノビフェニル（ＴＦＤＢ）及びＮ，Ｎ－ジメチルアセトアミド（ＤＭＡｃ）から濃度１５wt%のポリアミド酸溶液を得た。このポリアミド酸溶液をシリコンウェハ上にスピンコートした後オーブン中で７０℃で２時間、１６０℃で１時間、２５０℃で３０分、３８０℃で１時間加熱し、イミド化を行い、厚さ３０μmのポリイミドフィルムを得た。次にＴＦＤＢと酸無水物の混合物（６ＦＤＡ：９０ mol%、ピロメリット酸二無水物：１０ mol%）及びＤＭＡｃから下部クラッド層よりも屈折率の大きいポリイミドの前駆体であるポリアミド酸の濃度１５wt%溶液を得た。このポリアミド酸溶液を上記下部クラッド層の上にスピンコートした後オーブン中で７０℃で２時間、１６０℃で１時間、２５０℃で３０分、３８０℃で１時間加熱し、イミド化を行い、厚さ１０μmのコア層を形成した。このコア層の上に蒸着装置により、０．３μmのアルミニウム膜を形成した。次に通常のポジ型レジストをスピンコート法により塗布した後プリベークを行った。次に線幅１０μm、長さ６０mmのパターン形成用マスクを通して超高圧水銀ランプを用いて紫外線を照射した後現像液を用いて現像した。その後アフターベークをした。次にレジストでコートされていないアルミニウムのウェットエッチングを行った。洗浄乾燥後ドライエッチング装置を用いポリイミドの加工を行った。そしてポリイミドの上層にあるアルミニウムを上記したエッチング液で除去し、コア層が１０μm幅のリッジ型光導波路＊が得られた。更にこのリッジ型光導波路の上に下部クラッド層と同じポリアミド酸溶液をスピンコートした後オーブン中で７０℃で２時間、１６０℃で１時間、２５０℃で３０分、３８０℃で１時間加熱し、イミド化を行い、厚さ３０μmの上部クラッドを形成した。こうして作製したシリコンウェハ上のポリイミド光導波路を水中に浸漬し、放置したところ光導波路が形成されたポリイミドフィルムがはく離した。これを取出し、真空下１００℃で１時間乾燥した。次に光導波路が形成されたポリイミドフィルムに無電解メッキ法で銅を１８μmメッキし、電気配線・光配線混載フレキシブルプリント配線板用基板が得られた。更に通常のパターニング法により電気配線を形成し、電気配線・光配線混載フレキシブルプリント配線板を得た。

【００１６】

【発明の効果】本発明の電気配線・光配線混載フレキシブルプリント配線板は、電気信号と光信号を同時に伝送することが可能で、かつ柔軟性、軽量などの特徴を有しているため、今後の光通信装置、光情報装置の高度化に寄与できる効果がある。また電気配線・光配線混載フレキシブルプリント配線板用基板は、電気配線・光配線混載フレキシブルプリント配線板を容易に作製できる効果がある。

【図面の簡単な説明】

【図１】本発明の電気配線・光配線混載フレキシブルプリント配線板の１例の側面図である。

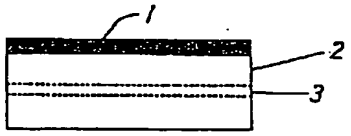
【図２】本発明の図１の電気配線・光配線混載フレキシブルプリント配線板の平面図である。

【図３】本発明の図１の電気配線・光配線混載フレキシブルプリント配線板の断面図である。

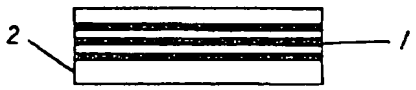
【符号の説明】

１：金属配線、２：クラッド、３：コア

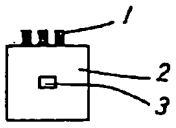
【図１】



【図２】



【図３】



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